Chapter 1
Introduction

1-1. Purpose

The purpose of this manual is to provide guidance in the structural design of vertical lift gates.

1-2. Scope

This manual presents criteria for the design of vertical lift gates used for water retention for routine or emergency operation in navigation projects, powerhouses, spillways, outlet works, and coastal hurricane protection or tide gates. For other types of gates, such as sluice gates, bonnet type gates, maintenance bulkheads, and slide gates, specific criteria have not been developed.

1-3. Applicability

This manual applies to all USACE Commands having responsibility for design of civil works projects.

1-4. References

References are listed in Appendix A.

1-5. Background

a. General. Several types of vertical lift gates are used in a variety of hydraulic structures, including spillways, low-level inlets/outlets, powerhouses, and navigation locks. In recent years, there have been considerable problems with the performance of vertical lift gates. The majority of these problems have occurred as a result of fatigue, causing fractures in main structural framing members of the gate. New criteria address methods to reduce fatigue and fracture through design and construction techniques. Research has proven that the serviceability of the gate can be improved by using proper materials and fabrication techniques. These fabrication techniques include the use of proper joint detailing and welding procedures. Proper material selection and material compatibilities are an essential part of providing long service life of the structure.

b. Recent case histories. Numerous gates have experienced problems related to fracture and fatigue. Results of investigations, most notably published in Engineer Technical Letter (ETL) 1110-2-346 and ETL 1110-2-351 and Computer-Aided Structural Engineering (CASE) Steel Structures Task Group (1993), identify methods for reducing fatigue stresses and selecting material type, which result in longer design lives for welded steel structures. Two case histories provided in Appendix B describe a background of failures in the existing gates, corrective actions taken, and replacement of the old gate with a new gate using new fatigue guidelines.

c. Design policy. Engineer Manual (EM) 1110-2-2105 specifies that Load Resistance and Factor Design (LRFD) is the preferred method of design and should be used for those structure types for which LRFD guidance is provided. Hence, this manual contains load criteria specified for designing vertical lift gates using LRFD. The designer is referenced to the design policy in EM 1110-2-2105 regarding the use of allowable stress design.

This engineer manual supersedes EM 1110-2-2701, dated 7 December 1962.